



Inter-comparison of Global Terrestrial Primary Production and Evapotranspiration Data Products between MODIS and VIIRS



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1. Introduction

The VIIRS terrestrial Evapotranspiration (ET) and Gross and Net Primary Production (GPP/NPP) data products are the continuity of the MODIS counterpart data products as MODIS is near the end of the mission, providing continuity of monitoring water and carbon fluxes of vegetated land surface in 500m resolution and at an 8-day interval. In this poster, we show the results from the recent Product Generation Executive (PGE) science tests of the Collection 2 (C02) VIIRS ET (VNP16 from S-NPP and VJ116 from JPSS-1) and GPP/NPP (VNP17 from S-NPP and VJ117 from JPSS-1) for year 2018. We compared the C02 VIIRS ET and GPP/NPP with the afternoon MODIS/Aqua Collection 6.1 (C61) counterparts, MYD16 and MYD17. **The good agreements between the VIIRS ET and GPP/NPP and MODIS Aqua counterparts shown here reveal readiness of the two PGEs for operationally generating and releasing the C02 VIIRS 16 and 17 data products to the public. Our efforts to recalibrate parameters for GPP/NPP (Endsley, et al., submitted to J.G.R.) and ET (priority of the next phase) for MODIS and VIIRS will further enhance the data quality for both MODIS and VIIRS.** The continuity of ET and GPP/NPP data products from MODIS to VIIRS data era will provide us key wall-to-wall ecological information on water and carbon fluxes of vegetated land surface at an 8-day interval. The long-term ET and GPP/NPP data products are vital to answer how terrestrial ecosystem changes in terms of water and carbon fluxes under changing climate and human activities.

2. Data Products and Methodology

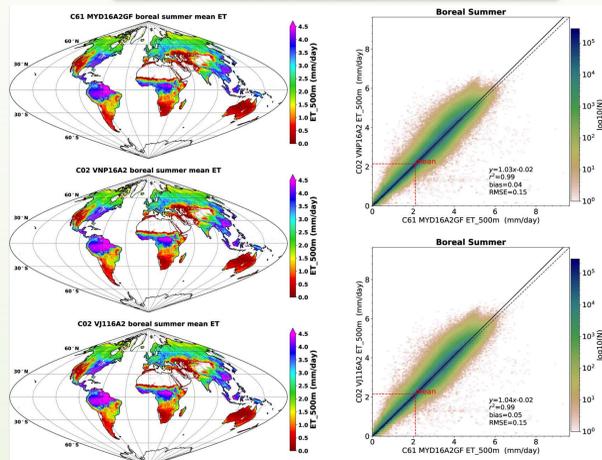
Table 1 lists the data sets used for the inter-comparisons. VIIRS ET and GPP/NPP are the outputs from the recent C02 PGEs science test, and C61 MODIS Aqua year-end Gap-Filled MYD16A2GF/MYD16A3GF and MYD17A2HGF/MYD17A3HGF are the baseline for comparisons. The two VIIRS forward data products use the operational VIIRS FPAR/LAI (VNP15A2H for S-NPP and VJ115A2H for JPSS-1), together with 5-year rolling climatology FPAR/LAI, an intermediate data product, to fill data gaps in the operational FPAR/LAI labeled with the poor data quality mainly caused by cloud contaminations. At the end of each year when all 8-day VIIRS FPAR/LAI are available, Gap-Filled VIIRS FPAR/LAI will be created as inputs to generate the year-end Gap-Filled VIIRS 8-day (A2) and annual (A3) ET and GPP/NPP. Thus, there is no forward annual A3 ET and GPP/NPP data products but just gap-filled.

We compared VIIRS 8-day A2 ET and GPP/NPP for two seasons: boreal summer and boreal winter times, and annual A3 total values. The inter-comparisons can provide us relatively full information on the agreement levels between VIIRS and MODIS ET and GPP/NPP at intra-annual and annual temporal scales. We show their spatial patterns and one-by-one comparisons with density distribution to have more meaningful statistical metrics. Please note all the data shown here are aggregated results by averaging a 5 by 5 500m window (i.e., 2.5km resolution per pixel). To save the space, we don't provide captions for table and figures because titles of subsections are clear descriptions of the contents.

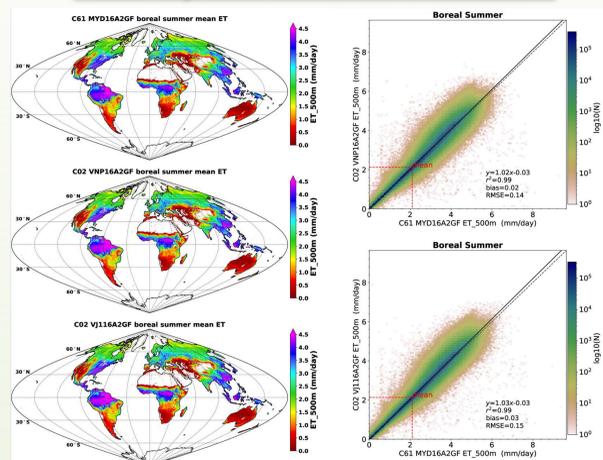
MODIS/VIIRS Data Products	VIIRS forward 8-day data products (C02 Science Test)	VIIRS gap-filled 8-day data products (C02 Science Test)	MODIS gap-filled 8-day data products (C61 baseline)	VIIRS gap-filled annual data products (C02 Science Test)	MODIS gap-filled annual data products (C61 baseline)
Evapotranspiration (ET)	VNP16A2 VJ116A2	VNP16A2GF VJ116A2GF	MYD16A2GF (baseline)	VNP16A3GF VJ116A3GF	MYD16A3GF (baseline)
Gross and Net Primary Production (GPP/NPP)	VNP17A2 VJ117A2	VNP17A2GF VJ117A2GF	MYD17A2HGF (baseline)	VNP17A3GF VJ117A3GF	MYD17A3HGF (baseline)

3.1 Results: Inter-Comparisons for Boreal Summer Season (Jun.-Jul.-Aug.)

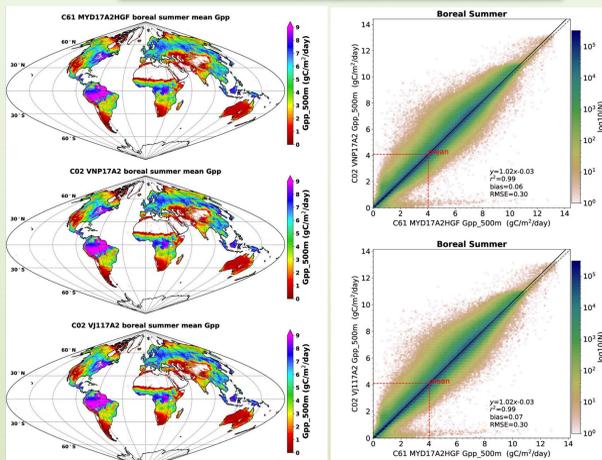
VIIRS forward 16A2 vs. MYD16A2GF



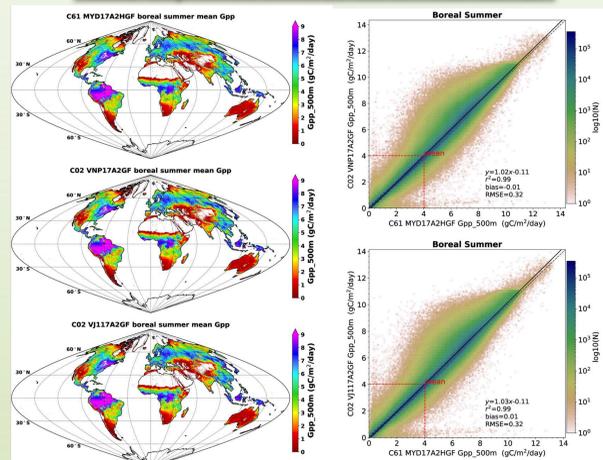
VIIRS Gap-Filled 16A2GF vs. MYD16A2GF



VIIRS forward 17A2 vs. MYD17A2HGF

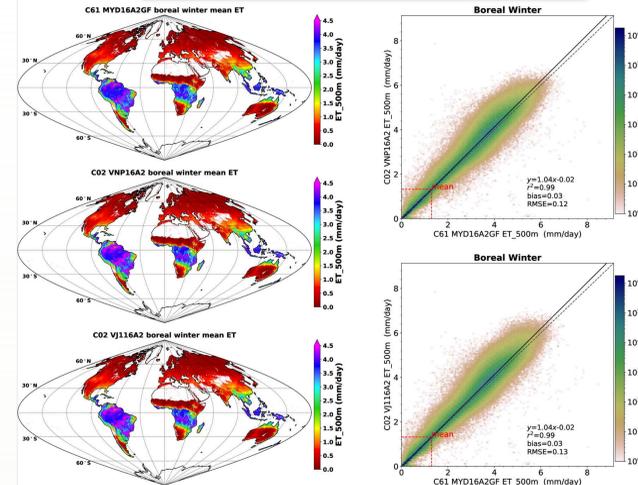


VIIRS Gap-Filled 17A2GF vs. MYD17A2HGF

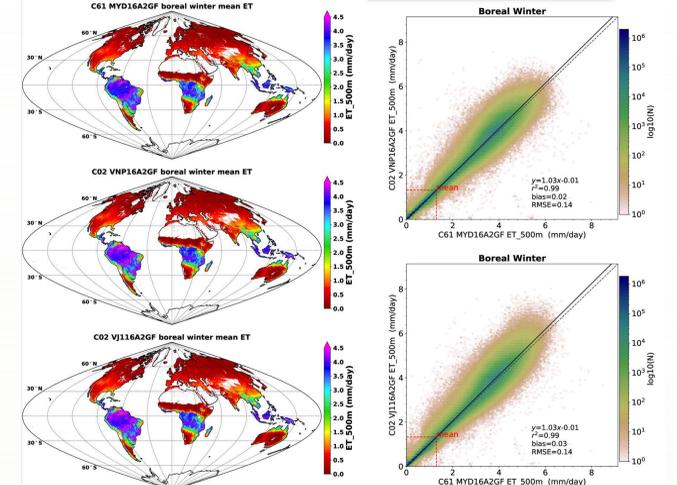


3.2 Results: Inter-Comparisons for Boreal Winter Season (Dec.-Jan.-Feb.)

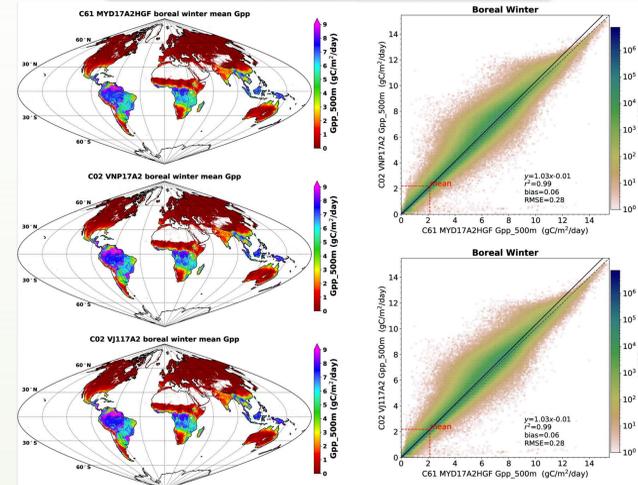
VIIRS forward 16A2 vs. MYD16A2GF



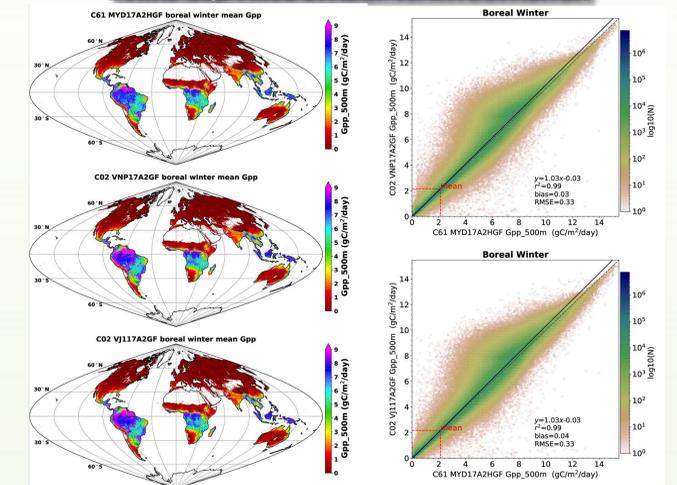
VIIRS Gap-Filled 16A2GF vs. MYD16A2GF



VIIRS forward 17A2 vs. MYD17A2HGF

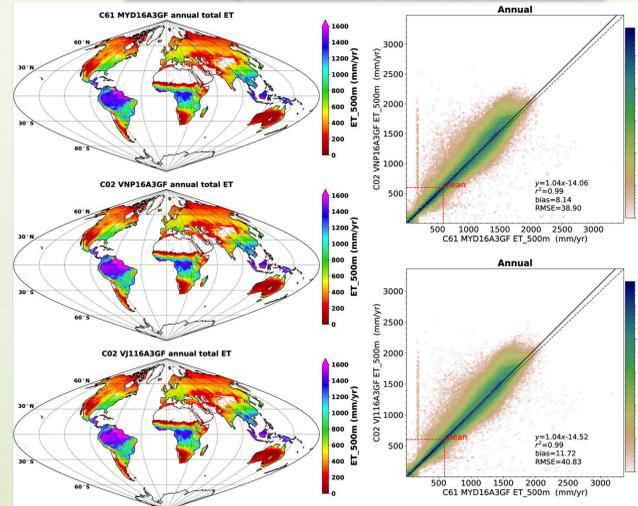


VIIRS Gap-Filled 17A2GF vs. MYD17A2HGF

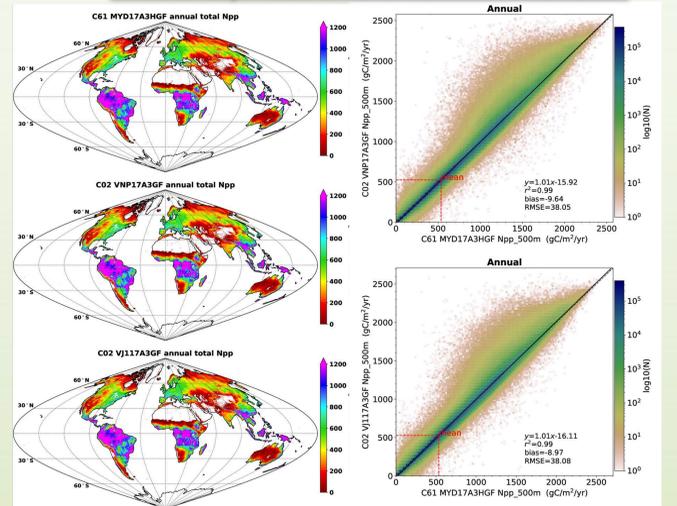


3.3. Results: Inter-Comparisons for A3 Gap-Filled annual total ET and NPP

VIIRS Gap-Filled 16A3GF vs. MYD16A3GF



VIIRS Gap-Filled 17A3GF vs. MYD17A3HGF



4. Conclusions

The inter-comparisons of the 8-day forward and year-end Gap-Filled VIIRS ET and GPP/NPP (VNP16A2/VJ116A2, VNP16A2GF/VJ117A2GF) with the MODIS 8-day Gap-Filled data products (MYD16A2GF and MYD17A2HGF) for boreal summer and winter seasons show general comparable and good agreements. Similarly, the inter-comparisons of annual Gap-Filled A3 total ET and NPP between VIIRS (VNP16A3GF/VJ116A3GF and VNP17A3GF/VJ117A3GF) and MODIS (MYD16A3GF and MYD17A3HGF) also show fair agreements. These results from the science tests indicate the two VIIRS PGEs are ready for generating and releasing the forward and year-end Gap-Filled VIIRS C02 data products to the public. Our current efforts of recalibrating parameters of GPP/NPP (Endsley et al., under review) and ET will further enhance the accuracy of MODIS and VIIRS ET and GPP/NPP data products. The VIIRS 16 and 17 data products will continue monitoring water and carbon fluxes of the vegetated earth surface in VIIRS era.

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